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# ESTIMATION OF SERUM LIPID PROFILE IN PATIENTS WITH IMPAIRED THYROID FUNCTION

Biochemistry

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## ABSTRACT

Thyroid function plays an important role in regulation of cellular activity and influences basal metabolic rate and hence general body metabolism. We carried out a study to estimate serum lipid profile in patients with impaired thyroid function. Total 150 subjects enrolled for the study were grouped on the basis of thyroid function viz. euthyroid, subclinical hypothyroidism, hypothyroidism and hyperthyroidism. Different variables of Serum Lipid Profile among the groups were compared. Serum cholesterol, TG and HDL levels were higher in the subclinical & hypothyroid group. These variables were significantly lower in the hyperthyroid group. The variation of serum TG was the most significant (F=11.37; P= 0.000). Serum VLDL levels were higher in the subclinical hypothyroid and hypothyroid group where as the levels were significantly lower in the hyperthyroid group. Serum LDL levels were as low as 62.09 ± 17.37 mg/dl in the hyperthyroid group and higher in the groups with reduced thyroid function.

## KEYWORDS

Lipid Profile, Thyroid function, Euthyroid, Subclinical hypothyroidism, Hypothyroidism and Hyperthyroidism

## INTRODUCTION

Thyroid hormones are essential for normal growth and maturation of skeletal system.[1] The thyroid gland secretes two important hormones thyroxine and triiodothyronine which are commonly known as T4 and T3. T3 is biologically more active form of thyroid hormone.[2] The secretion of thyroid hormones is controlled by the hyothalamus-pituitary-thyroid axis. Plasma levels of T4 and T3 are regulated by a feedback mechanism, in which hypthalamic thyrotropin-releasing hormone (TRH) stimulates the synthesis and release of thyrotropin (TSH) by the anterior pituitary, thus stimulating the secretion of T4 and T3 by the thyroid gland.[3]

Hypothyroidism and hyperthyroidism are two primary pathological conditions that involve thyroid glands.[4] The serum TSH assay is an accurate test for detecting out of range circulating levels of thyroid hormones for either of hypothyroidism and hyperthyroidism.[5]

Thyroid hormones play an important role in the metabolism of lipids which include almost all aspects of lipid metabolism like lipid digestion, transport, biosynthesis and catabolism. Thyroid hormones stimulate the enzymes involved in the lipid metabolism such as lipoprotein lipase, hepatic lipase, lecithin cholesterol acyltransferase (LCAT) and cholesterol ester transfer protein (CETP).[6] Thyroid hormones along with other hormones (e.g. insulin, cortisol, estrogen) play an important role in regulation of the activity of 3-hydroxy-3-methyl-glutaryl coenzyme A reductase (HMG CoA reductase) which is the rate limiting enzymes in the liver.[7]

In general, Hypothyroidism is known to cause hypercholesterolemia, elevated low-density lipoprotein (LDL), and hypertriglyceridemia.[8] Despite the increased activity of the HMG-CoA reductase, levels of total cholesterol, Low density lipoprotein cholesterol, tend to decrease in patients with clinical or subclinical hyperthyroidism.[9] The thyroid hormone stimulates the hepatic de novo cholesterol synthesis by inducing the HMG-CoA reductase that catalyzes the conversion of HMG-CoA to mevalonate, the first step in the biosynthesis of cholesterol. This results in an enhanced intracellular cholesterol concentration in hyperthyroidism and a decreased one in hypothyroidism.[10]

Serum lipid profile is a marker of cardiovascular function. Thyroid hormones regulate the overall basal metabolic rate and hence their activity may significantly influence the metabolism of above variables.

Several studies have been conducted to evaluate the serum lipid profile levels in either hypothyroidism or hyperthyroidism. This study attempted to evaluate cases of normal thyroid function and compare the results with hypo and hyperactivity of thyroid hormones. The present study was therefore planned to assess **"**Serum Lipid Profile in relation to Thyroid Function**".**

## AIMS AND OBJECTIVES

To estimate serum lipid profile in patients with impaired thyroid function.

## MATERIALS AND METHODS

The study was conducted in Department of Biochemistry in association with Department of General Medicine and Endocrinology of Mahatma Gandhi Medical College & Hospital, Jaipur. Total 150 subjects were enrolled. Patients enrolled in the study were recommended not to have heavy exercise at least 24hours before examination.

### Study population

Total 150 patients who fulfil the following criteria were enrolled for the study.

### Inclusion Criteria:

1. Age up to 60 years, either gender.
2. Patients who were willing to participate and sign consent document.
3. Patient willing to comply with the protocol requirements.

### Exclusion Criteria:

1. Paediatric age group
2. Patient with renal disorders
3. Patient with hepatic disorders

### Study design and methodology:

- A study protocol was designed before undertaking this study, which was approved by the Institutional Ethics Committee and informed consent was taken before enrolling the patients for the study.
- Blood samples after overnight fasting were collected by standard aseptic techniques. The samples collected were subjected to following investigations:
- Serum T3, T4, TSH by CLIA using Vitros ECI.
- Serum Lipid profile (Serum cholesterol, TG, HDL, LDL, & VLDL).

### Statistical analysis:

Total 150 subjects enrolled for the study were grouped on the basis of

thyroid function viz. euthyroid, subclinical hypothyroidism, hypothyroidism and hyperthyroidism. The results obtained were presented as mean ± SD and subjected to statistical analysis. To compare the various parameters in the above groups, one way ANOVA test was applied. To evaluate the correlation between thyroid hormones and other variables, Pearson's correlation was applied. P value ≤ 0.05 was considered as statistically significant.

## OBSERVATION

**Table 1: Distribution of T3, T4 & TSH in the groups based on Thyroid Function**

| Parameters | Euthyroid (n=45) | Subclinical hypothyroid (n=38) | Hypothyroid (n=46) | Hyperthyroid (n=21) | F value | P value |
|---|---|---|---|---|---|---|
| **T3 (ng/ml)** | 1.27±0.29 | 1.27±0.29 | 0.68±0.34 | 2.13±0.92 | 56.07 | 0.000 |
| **T4 (µg/dl)** | 8.65±2.36 | 8.47±1.91 | 4.88±1.53 | 16.20±4.59 | 99.24 | 0.000 |
| **TSH (µIU/ml)** | 2.41±1.04 | 9.66±4.92 | 10.85±7.60 | 0.07±0.12 | 39.44 | 0.000 |

**Table 2: Distribution of Serum cholesterol, Serum triglycerides, Serum HDL, Serum LDL and Serum VLDL in the groups based on Thyroid Function**

| Parameters | Euthyroid (n=45) | Subclinical hypothyroid (n=38) | Hypothyroid (n=46) | Hyperthyroid (n=21) | F value | P value |
|---|---|---|---|---|---|---|
| **Cholesterol (mg/dl)** | 147.55±37.59 | 162.32±36.21 | 164.24±43.56 | 129.50±21.50 | 5.20 | 0.002 |
| **Triglycerides (mg/dl)** | 127.74±46.19 | 172.50±67.75 | 178.15±50.74 | 115.88±51.74 | 11.37 | 0.000 |
| **HDL (mg/dl)** | 42.01±10.33 | 36.61±9.97 | 38.94±8.86 | 44.24±11.70 | 4.10 | 0.008 |
| **LDL (mg/dl)** | 79.09 ± 31.48 | 91.74 ± 26.32 | 89.67 ± 42.06 | 62.09 ± 17.37 | 4.66 | 0.004 |
| **VLDL (mg/dl)** | 25.55±9.24 | 33.97±12.74 | 35.63±10.15 | 23.18±10.35 | 11.46 | 0.000 |

**Table 3: Correlation coefficient between TSH and Lipid profile**

| Test | Correlation coefficient (r) | P-Value |
|---|---|---|
| TSH v/s Cholesterol | 0.169 | NS |
| TSH v/s Triglycerides | 0.209 | 0.10 |
| TSH v/s HDL | -146 | NS |
| TSH v/s LDL | 0.168 | 0.0397 |
| TSH v/s VLDL | 0.209 | 0.10 |

## RESULTS AND DISCUSSION

Thyroid hormones regulate a wide range of metabolic reactions including lipids, carbohydrates and protein metabolism.[11] The present study was planned to assess the association of thyroid function with components of lipid. A total of 150 patients visiting the outpatient Department of General Medicine and Endocrinology of Mahatma Gandhi Medical College & Hospital, Jaipur were enrolled for the study based on predefined inclusion and exclusion criteria. Blood samples were collected using standard aseptic techniques and evaluated for serum T3, T4, TSH and lipid profile.

The results obtained for various variables were calculated as mean ± SD and subjected to statistical evaluation. On applying one way ANOVA among the four groups, it was observed that

Tables:1- shows the mean serum T3, T4 and TSH levels among the four groups. Mean Serum T3 levels were as low as 0.68 ng/ml in the hypothyroid group and as high as 2.13 ng/ml in the hyperthyroid group. Similarly mean T4 levels were as low as 4.88 µg/dl in the hypothyroid group while it was as high as 16.20 µg/dl in the hyperthyroid group. Mean serum TSH ranged from 0.07 to 10.85 µIU/ml. Serum TSH assay is considered as a reliable and accurate test for detection of abnormal levels of thyroid hormones for hypothyroid and hyperthyroid.

Table: 2 exhibit the mean Serum cholesterol levels. It was observed that there was a significant variation in the mean serum cholesterol levels among the four groups. Serum cholesterol levels were higher in the subclinical & hypothyroid group whereas the levels were significantly lower in the hyperthyroid group. Similar findings were also reported in the mean serum triglycerides and HDL levels. However, F value (11.37) was higher for triglycerides levels as compared to serum cholesterol and HDL levels.

Similar to the above findings, Lee WY[12] et. al. have reported elevated serum cholesterol levels in subclinical hypothyroidism. Singh BM[13] et. al. have also reported that serum cholesterol, triglycerides, LDL were significantly raised in overt hypothyroidism as compared to control whereas HDL level was significantly lower. Previous study by Duntas LH[14] has exhibited that levels of total cholesterol, LDL cholesterol, Apo B and Lp (a) tend to decrease in patients with clinical and subclinical hyperthyroidism. In a recent research by Fabbrini[15] et. al. observed that increased serum triglycerides in overt and subclinical hypothyroid patients with reduced triglycerides in the subclinical and overt hyperthyroid groups.

For the present study, serum LDL and VLDL were calculated using Freidwald's formula.

On analyzing the data statistically, it was observed that both these parameters exhibited significant difference. As obvious, serum VLDL results were similar to the changes of serum TG that is significantly higher values in the subclinical hypothyroid and hypothyroid group.

The Serum LDL levels were as low as 62.09 ± 17.37 mg/dL in the hyperthyroid group. On the other hand the LDL levels were higher in the groups with reduced thyroid function. Al Sayed et. al.[16] have found that patients with subclinical hypothyroidism exhibited elevated LDL cholesterol. Similarly, The Colorado thyroid disease prevalence study (2000) showed that total cholesterol and LDL-C in subclinical hypothyroidism were significantly higher than in euthyroidism but triglycerides and HDL-C were not significantly different. Althus BU et. al.[17], 1988 long back had reported that in subjects with subclinical hypothyroidism LDL-C levels were significantly increased and HDL-C levels were decreased when compared to euthyroid subjects after adjustment for age, sex and BMI.

A recent study by Sharma P et. al.[18], 2013 on the pattern of dyslipidemia in hypothyroidism also support the findings of the present study.

Thyroid hormones are said to regulate the expression of enzymes involved in various steps of lipid metabolism. The hypo activity of thyroid hormones reduces the rate of fatty acid synthesis and lipolysis. Increased serum cholesterol levels in patients with hypothyroidism is attributed to proportionally greater transient retardation in breakdown than in synthesis.[18]

Further, LDL cholesterol is assumed to be elevated less efficiently from circulation which in turn is caused due to decreased T3 dependant gene expression of hepatic LDL- receptor. Elevated TG levels can be explained as an outcome of decreased lipoprotein lipase activity. Overall, the hypo-activity of the thyroid function may result in atherogenic lipid profile.[18]

To analyze the direct correlation between serum TSH and other variable, Pearson's correlation was applied. Tables 3 show that a positive correlation was observed between serum TSH and serum triglycerides, LDL, VLDL.

Findings of the present study suggest that thyroid dysfunction especially abnormal TSH levels influence directly or indirectly the components of lipid profile. Thyroid function regulates the basal metabolic rate and hence influences the activity of various metabolic enzymes in a complex interrelated process. Impairment of thyroid function therefore, affects the functions of some major organs like kidney, liver, musculo-skeletal system etc. The study therefore, strongly recommends screening of patients suffering from thyroid disorders for serum lipid profile.

## CONCLUSION

Findings of the present study suggest that thyroid function significantly influences the status of lipids profile. Since thyroid hormones directly affect the BMR, hypothyroidism slows down the overall rate of metabolism leading to increase lipid levels. Hyper secretion of thyroid hormones on the other hand, increases the rate of

metabolism, thereby decreasing serum lipid levels. Dyslipidemia is said to be an independent risk marker of CVD. High levels of serum cholesterol & TG may therefore lead to development of such complications. On the other hand, cholesterol is required for synthesis of some very important compounds. Therefore, decrease in cholesterol levels due to hyperthyroidism may affect the synthesis of these compounds.

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